# Vector Arithmetic (Section Formula)

AI24BTECH11021 - Manvik Muthyapu

**Question**:

Show that the points $\mathbf{A}\,(-6,10)\,,\mathbf{B}\,(-4,6)$ and $\mathbf{C}\,(3,-8)$ are collinear and prove that $AB = \frac{2}{9}AC$.

**Solution:**

If this determinant is zero, $\begin{vmatrix} 1 & 1 & 1 \\ -6 & -4 & 3 \\ 10 & 6 & -8 \end{vmatrix}$ then $A$, $B$, and $C$ are collinear.

$$\text{Det} = \begin{vmatrix} 1 & 1 & 1 \\ -6 & -4 & 3 \\ 10 & 6 & -8 \end{vmatrix} = 1 \cdot ((-4)(-8) - (3)(6)) - 1 \cdot ((-6)(-8) - (3)(10)) + 1 \cdot ((-6)(6) - (-4)(10))$$

$$= 1 \cdot (32 - 18) - 1 \cdot (48 - 30) + 1 \cdot (-36 + 40)$$

$$= 1 \cdot 14 - 1 \cdot 18 + 1 \cdot 4 = 14 - 18 + 4 = 0$$

$\therefore$ $A$, $B$, and $C$ are collinear.

Using the section formula, if $B$ divides $AC$ in the ratio $m : n$, then:

$$B\left(\frac{m \cdot 3 + n \cdot (-6)}{m+n}, \frac{m \cdot (-8) + n \cdot 10}{m+n}\right) = (-4, 6)$$

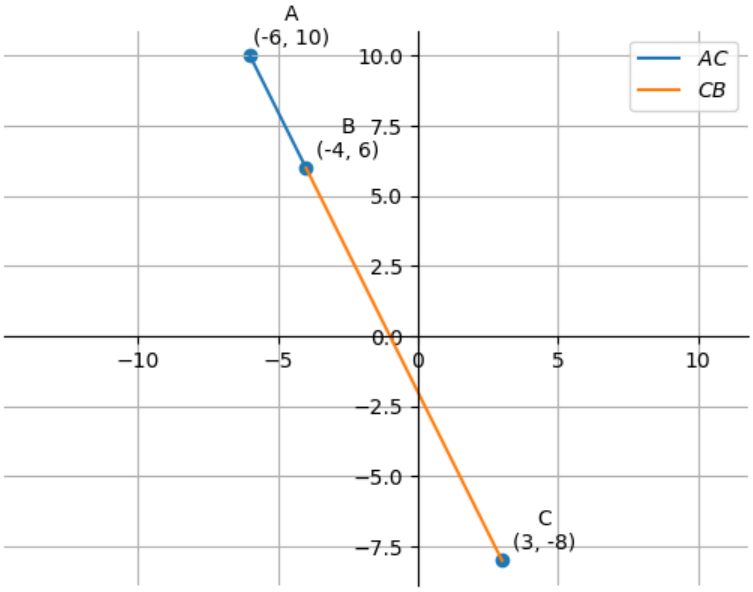
Equating the coordinates, we get

$$\frac{m}{n} = \frac{2}{7}$$

$\therefore$ It confirms that $B$ divides $AC$ in the ratio $2 : 7$. Since $B$ divides $AC$in the ratio $2 : 7$, we have:

$$\frac{AB}{AC} = \frac{2}{2+7} = \frac{2}{9}$$

Hence, $AB = \frac{2}{9}AC$, as required.


A
(-6, 10)
B
(-4, 6)
C
(3, -8)
AC
CB
10.0
7.5
5.0
2.5
0.0
−2.5
−5.0
−7.5
−10
−5
0
5
10